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SURGERY.

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**THE PRESENT STATUS OF DRAINAGE IN
SURGERY.¹**

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THE title of this paper, while seeming to embrace the entire subject of surgical drainage, is intended to refer to the question of primary wound-drainage. Our present knowledge of the principles upon which success in the treatment of septic wounds is founded will not permit of even the dream that artificial drainage can ever be eliminated from our resources as a secondary measure in wound-therapeutics; hence secondary drainage or pus-drainage will not be discussed here.

Before the researches and work of Chassaignac, medical history gives us little accurate data as to the progress of drainage through the past ages. We are enabled to trace the principle of drainage in the work of our forefathers in surgery by a continual warfare, with first one and then another faction in the ascendancy, as to the relative advantages of the open and closed method of wound-treatment, which was but the expression of a sentiment for or against primary wound-drainage. With limited exceptions, the

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efforts of older surgeons to establish primary drainage partook of the natural variety, content to accomplish their purpose by so shaping incisions as to facilitate discharge, or by the practice of a partial or complete open method of treatment. I say this was the method, with limited exceptions, for we do find mention of the introduction of pledgets of lint and gauze as a primary procedure, though the purpose and limitation of these measures were poorly understood. As a matter of fact, the prevailing idea was that they gave an exit to products of inflammation, and they were left in the wound long enough to provoke what it was intended to relieve. To the great discredit of some modern surgeons, traces of this combined primary and secondary drainage, or perversion of drainage, are still to be found at the present day.

Interesting and instructive as it would be to trace the great principle of drainage through the network of advances in past surgical progress, it is not of direct and practical importance enough for our present purpose. The subject of primary wound-drainage may be said to be under very active discussion at the present time. It is true the argument is, in some respects, a subdued one, for men naturally hesitate to take sides against a measure which every surgeon recognizes has been second to none in saving human life; yet, within the past two years, and especially within the past twelve months, we have all seen in the journals and society reports long lists of operations, all with the ever-inserted line "Closed without drainage." Converse in private with almost any one of the authors of such

a paper, and you will find him more bold, probably admitting that he believes the time has arrived in wound-treatment when primary drainage can be dispensed with entirely.

We all know that beneficial as drainage is, and has been to our art, yet it is not without its evils; that in its application we either introduce into wounds a foreign substance, or at least an objectionable material. Hence we hail such expressions as at least prophetic of the time when our ideal shall be attained; when the brilliancy and achievements of modern surgery shall have forever reduced the open wound to the benign conditions of a subcutaneous one. Again, in accounting for the facts contained in such assertions as those referred to, we attempt to explain by the different conditions that probably surrounded the work of such men; the nature of the operations performed must have been very different from that of those encountered by men doing a different line of work, or general surgery. In others such reports tend to create a feeling of dissatisfaction with their own work (a good feeling to have produced at times), probably mingled with the disagreeable thought that they are not in the front file.

After twenty-two years of the more or less scientific use of primary artificial drainage in open wounds, we are confronted with the question: Is drainage a necessity; if so, when, and what is the best method of practising it? The reply to the first part of our question involves a brief *résumé* of the principles upon which primary drainage is founded. Such drainage is intended to convey

from cavities and recesses of wounds, blood and serum. When the physiologic time for this has expired, the function of primary drainage has ceased. This time, with rare exceptions, is fairly definite, and is between twenty-four and sixty hours. To wait longer is to encourage trouble by the maintenance of a disagreeable guest; to remove before the lapse of twenty-four hours is taking risks not warranted in the premises. When the surgical conditions are such as to give evidence that its work is accomplished, the drain should be removed.

Primary wound-secretion is justly accredited with being the nidus or soil upon and in which multiply and develop the noxious agents so inimical to healthy wound-repair; hence the limitation of its production, its sterilization or its removal by some channel from the wounded tissue becomes a surgical necessity based upon the soundest surgical science. If we secure a limitation in the production of serum, or its sterilization *in situ*, is the successful progress of a wound assured without drainage? As to the first, we answer unhesitatingly "Yes." The nature and extent of a wound, the character of tissue involved, or both, may be such that with careful aseptic precautions and thorough hemostasis, the production of serum is practically prevented—at least as a factor in disturbed repair; hence, drainage is not only superfluous, but detrimental. In the more extensive wounds, we have in the buried gut-suture a means of the greatest value in enabling us to dispense with drainage by obliterating spaces, securing compression and rest, and thus preventing pernicious collections of serum. If we ever expect

to succeed in the successful and uniform closing of large amputation-wounds without drainage, I feel satisfied that it can only be accomplished by means of the deep buried suture, which obliterates the deeper parts of such wounds. Other means, while often successful, are not attended with the positive and uniform results that should characterize most modern surgical work. In this connection it may be added that the same principle of deep suture may often be carried out by greater attention to extraneous means of compression by gauze compresses, which, by compression from without, tend to obliterate internal spaces. As an accessory means of limiting serous exudation must be mentioned the necessity of a more general use of measures of immobilization in soft-tissue wounds, and thorough attention to systemic or alimentary drainage. Thus, when the production of serum can be limited, other things being equal, drainage may be dispensed with.

Secondly, Will the sterilization of serum *in situ* assure the progress of a wound without disturbance? Let us dwell upon this a moment, for in the elucidation of this point rests the chief answer to the question: "Can drainage be dispensed with?" To illustrate this point, we will suppose a wound under the following favorable conditions: Perfect sterilization of all tissue adjacent and in the lines of continuity; perfect sterilization of everything brought in contact with the wound; perfect hemostasis; perfect approximation of the skin and superficial structures, and perfect protective dressings. The only undesirable feature about such a hypothetical

case as that stated is that there are deep spaces and pockets in which serum accumulates.

With all the aforestated favorable protective conditions, it is reasonable to suppose that this serum is as unoffending as in a subcutaneous wound. We grant that it may, indeed the probability is that it will, if in sufficient quantity, mechanically excite such irritation as may bring into being two latent elements of disturbance. The first of these is to be regarded in the knowledge that no wounded tissue, once exposed to the air, other than that of the highest mountains, or mid-ocean, is perfectly free from contamination; it probably has lodged in it pus-forming microorganisms deposited by the air, yet in such limited quantity that if further ingress is excluded, and not too much and luxuriant soil provided for their development, the vital resistance of the tissues is able to take care of them. Again, it is not safe surgery to tempt the lonely microorganism in his occasional voyages around the blood-circuit, with large and fertile fields of even sterilized serum, pent up in tissues and cavities of the body. As practical surgeons, we should ever remember that the aspiration or drainage of a hydrops articuli or pleuritic effusion probably saves the patient from a future purulent accumulation, with all of its disastrous attendants. Then tension may, by irritation, convert an accumulation of serum into a dangerous wound-disturbance, calling into activity latent microorganisms which would otherwise have been disposed of by the tissues. Lastly, in this connection must not be forgotten the fact, that primary wound-secretion, though so protected as to be a barren soil

for the growth of disturbing agents, may, by its mechanical effects, be fatal to the functional interests of certain wounded structures, notably the brain and cord.

To this, the first part of our query, and one that the idealist in surgery is almost answering in the affirmative, we say "No." I have not dwelt upon the greatly differing conditions that exist between the work of the specialist and that of the general surgeon, or, more properly, the conditions that confront us in accidental surgery in contradistinction to surgery of selection and timely preparation. These differences readily suggest themselves to the practical general surgeon who has to deal almost daily with contused and lacerated wounds, the result of mine or railroad accident, where gross dirt and foreign bodies constitute no small element in determining the necessity for drainage, if good results are to be expected.

The second part of our question: "When shall we drain?" has been anticipated pretty largely in the previous discussion of the necessity for drainage. A proper appreciation of the function of drainage; conditions which surround the wound and manner of infliction; the perfectness of our appliances, and the constitution of the patient will be the chief determining factors. The axiom in abdominal surgery, "When in doubt, drain," is a most excellent one in general surgical practice, unless, like some surgeons I have known in abdominal work, always doubting. Probably we shall best know when to drain by formulating rules when not to drain. If the deeper parts of a wound can be approximated; if

pockets and recesses can be obliterated by suture or compression ; if the conditions favor natural drainage, dispense with drains. The buried suture will eliminate in a scientific way more drainage-tubes than any measure we are now acquainted with.

How shall we drain? Shall it be by tubular or capillary means? With material of an absorbable kind, or material that can be removed from the wound after its function of drainage has been performed? To answer these questions, let us again think of the purposes of primary drainage, and we shall see that a failure upon the part of the profession to appreciate the best forms of drainage is due to the want of knowledge in its management. If the surgeon knows how to manage drainage when once established, he will not be long in discovering the best material, at least for his own use. As between tubular and capillary drains in other than wounds of cavities of the body, it seems the preference should always be given to those acting by capillarity. With a thorough appreciation of the time required for primary drainage, and a knowledge of how the fluids, blood and serum, escape from wounds, there does not seem a valid reason why rubber tubes or absorbable tubular drains should ever be used. Certainly, when possible, preference should be given to a material the removal of which does not excite disturbance in the wound ; also to material that so closely approximates the tissues in its composition as to permit of its softening, liquefaction, and final absorption. Such a substance is found in catgut strands. In large wounds, with free secretion, six or eight threads of large gut, made to traverse the

entire deep part of the wound, and projecting from both angles, will drain it more effectually and more certainly than a fenestrated rubber tube of one-third inch in diameter. If there is any difficulty from bowing or fixing just where wanted, the method of Mr. Chiene (in which the strands of gut are tied in a bundle by a strand around the middle, and these with a needle attached sewed into the bottom of the wound) may be practised. Such a drain does not become plugged by blood-clot, and by virtue of its capillary action it will decant fluids from the bottom of pockets when a tubular drain would not. It is painless, for it does not produce compression; it does not soften too soon—*i. e.*, before its function is fulfilled. No dressings have to be disturbed for its removal. It lessens the paraphernalia of the surgical outfit, and is thus an element of simplicity, which, in turn, is one of the greatest elements of safety in surgical practice. The same bottle may contain the materials with which you tie the bleeding vessel, make your drain, approximate the wounded surfaces, and which you again use as buried suture to prevent drainage. The size of the gut used, as well as the number of strands, should be proportioned to the size of the wound to be drained.

If there is troublesome parenchymatous hemorrhage, or oozing from a large denuded surface, and it is desirable to combine drainage and hemostasis in the same measure, strips of iodoform-gauze form the best method of primary drainage. In all other surgery, with the exception of the cavities of the body, the catgut strands are to be preferred.

SUMMARY.

1. The principle of artificial drainage in surgery, while very ancient, was imperfectly understood, and was oftentimes as much a factor for evil as for good.

2. Though our knowledge of the principles that govern a healthy regeneration of wounded structures has greatly advanced, and our progress in wound-therapeutics has kept pace, we fail to appreciate how artificial drainage can be altogether dispensed with in surgical practice.

3. To lessen the use of artificial drainage it is necessary to thoroughly apply the principles of asepsis and antisepsis, combined with buried sutures, fixation, and alimentary or systemic drainage.

4. If for any reason the exudation of serum cannot be controlled, its removal by drainage is a safer surgical measure than any attempt at sterilization *in situ*.

5. The time required for primary drainage is from twenty-four to sixty hours; to wait longer is to encourage trouble; to remove sooner than twenty-four hours is to take unwarranted risks.

6. Capillary drainage is to be preferred to tubular drainage in wounds other than those of the large cavities. For this purpose absorbable material should be selected, catgut being the best.

7. When it is desirable to combine hemostasis and drainage in the same measure, the strips of iodoform-gauze, as recommended by Mikulicz, fulfil a most useful purpose.

8. When natural drainage can be utilized without producing unsightly cicatrices, artificial drainage should be dispensed with; when feasible, the two should be combined.

9. Wounds involving the brain and cord had best be drained, to avoid mechanical violence to the function of delicate structures by retained serum.

10. Necessity for artificial drainage will most often

arise in wounds invading the large cavities ; herein flexible, tubular, glass drains best meet the requirements, aided or not by materials acting by capillarity.

11. The method of secondary suture after primary wound-secretion is over, advised by Kocher, seems to possess no advantage over drains that have to be removed, and certainly is not to be compared in convenience, comfort, etc., with the patient, to absorbable capillary drains.

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